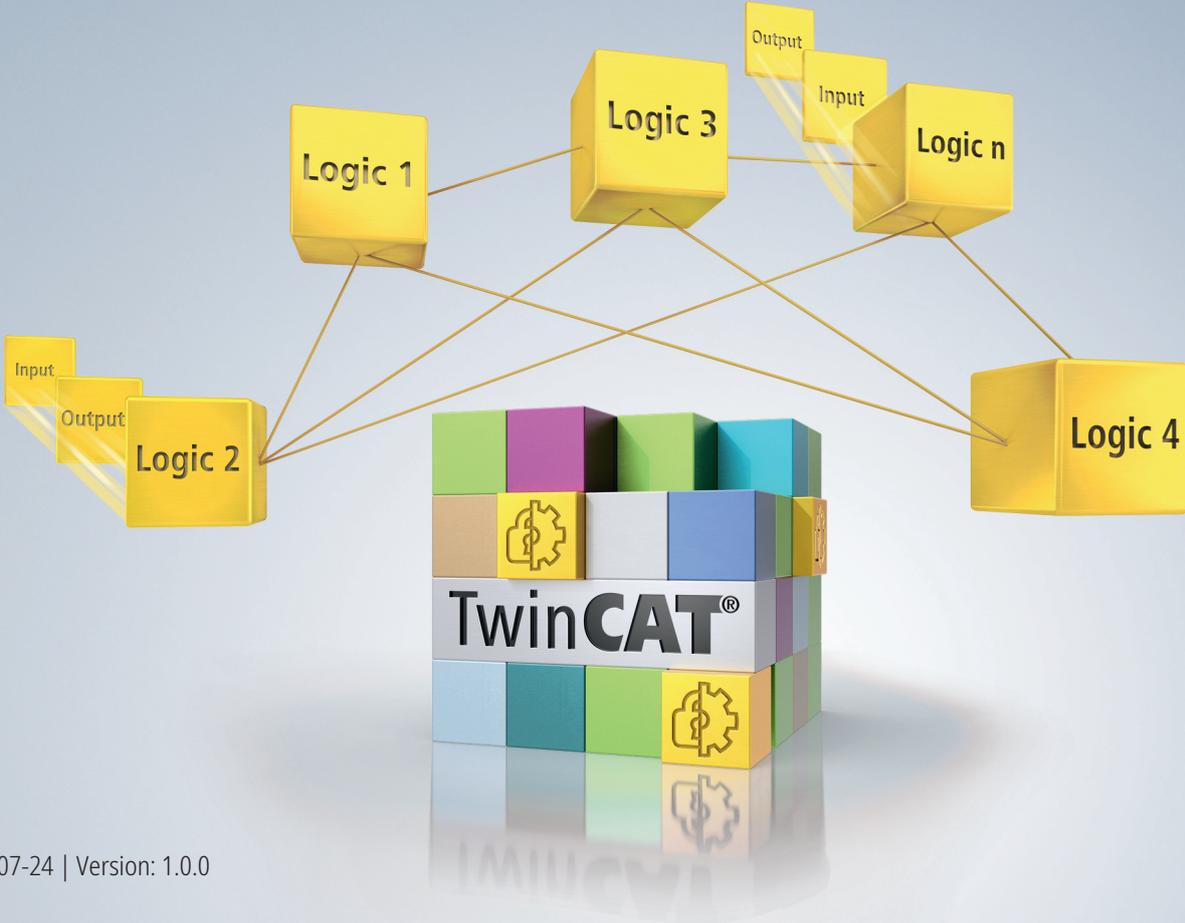


Documentation | EN

# TwinSAFE User FBs

TwinCAT 3 Safety Editor





# Table of contents

<b>1</b>	<b>Notes on the documentation.....</b>	<b>5</b>
1.1	Disclaimer.....	5
1.1.1	Trademarks .....	5
1.1.2	Limitation of liability .....	5
1.1.3	Copyright.....	5
1.1.4	Third-party trademarks.....	5
1.2	Documentation issue status .....	6
1.3	Staff qualification .....	6
1.4	Safety and instruction.....	7
1.5	Support and Service.....	8
1.6	Notes on information security.....	9
<b>2</b>	<b>Use.....</b>	<b>10</b>
<b>3</b>	<b>Create User FBs .....</b>	<b>11</b>
3.1	Create new .....	11
3.2	Reuse.....	12
3.2.1	Add an existing User FB .....	12
3.2.2	About Copy/Cut/Paste.....	12
3.3	Creating User FBs from existing applications .....	13
<b>4</b>	<b>Use User FBs.....</b>	<b>18</b>
4.1	About the Toolbox .....	18
4.2	About the "Add" command .....	18
<b>5</b>	<b>User FB instance.....</b>	<b>20</b>
5.1	Properties.....	20
5.2	Extract.....	20
5.3	Update.....	20
<b>6</b>	<b>User FB definition .....</b>	<b>21</b>
6.1	Properties.....	21
6.2	Variables .....	21
6.3	Save User FB definition .....	22
<b>7</b>	<b>Relationship between User FB instance and User FB definition.....</b>	<b>23</b>
<b>8</b>	<b>User FB libraries .....</b>	<b>24</b>
8.1	Saving User FBs in libraries .....	24
8.2	Repository Manager .....	25
8.3	Add library .....	27
8.4	Using User FBs from libraries .....	29
<b>9</b>	<b>Online View.....</b>	<b>30</b>
<b>10</b>	<b>Documentation .....</b>	<b>32</b>
<b>11</b>	<b>TC3 Export/Import.....</b>	<b>33</b>



# 1 Notes on the documentation

## 1.1 Disclaimer

Beckhoff products are subject to continuous further development. We reserve the right to revise the documentation at any time and without notice. No claims for the modification of products that have already been supplied may be made on the basis of the data, diagrams, and descriptions in this documentation.

In this documentation, we define all permissible use cases whose properties and operating conditions we can guarantee. The use cases we define are fully tested and certified. Any other use cases not described in this documentation, require the approval of Beckhoff Automation GmbH & Co KG.

### 1.1.1 Trademarks

Beckhoff®, TwinCAT®, TwinCAT/BSD®, TC/BSD®, EtherCAT®, EtherCAT G®, EtherCAT G10®, EtherCAT P®, Safety over EtherCAT®, TwinSAFE®, XFC®, XTS® and XPlanar® are registered and licensed trademarks of Beckhoff Automation GmbH.

The use of other brand names or designations by third parties may lead to an infringement of the rights of the owners of the corresponding designations.



EtherCAT® is a registered trademark and patented technology, licensed by Beckhoff Automation GmbH.



Safety over EtherCAT® is a registered trademark and patented technology, licensed by Beckhoff Automation GmbH.

### 1.1.2 Limitation of liability

All components in this product as described in the operating instructions are delivered in a specific configuration of hardware and software, depending on the application regulations. Modifications and changes to the hardware and/or software configuration that go beyond the documented options are prohibited and nullify the liability of Beckhoff Automation GmbH & Co. KG.

**The following is excluded from the liability:**

- Failure to observe these operating instructions
- Improper use
- Use of untrained personnel
- Use of unauthorized spare parts

### 1.1.3 Copyright

© Beckhoff Automation GmbH & Co. KG, Germany.

The distribution and reproduction of this document as well as the use and communication of its contents without express authorization are prohibited.

Offenders will be held liable for the payment of damages. All rights reserved in the event of the grant of a patent, utility model or design.

### 1.1.4 Third-party trademarks

Trademarks of third parties may be used in this documentation. You can find the trademark notices here: <https://www.beckhoff.com/trademarks>.

## 1.2 Documentation issue status

Issue	Comment
1.0.0	<ul style="list-style-type: none"><li>• First released version</li></ul>
0.0.1	<ul style="list-style-type: none"><li>• Preliminary (internal only)</li></ul>

### Origin of the document

The original documentation is written in German. All other languages are derived from the German original.

### Product features

Only the product properties specified in the current operating instructions are valid. Further information given on the product pages of the Beckhoff homepage, in emails or in other publications is not authoritative.

### Currentness

Please check whether you are using the current and valid version of this document. The current version can be downloaded from the Beckhoff homepage at <http://www.beckhoff.de/twinsafe>. In case of doubt, please contact Technical Support (see Beckhoff Services).

## 1.3 Staff qualification

These operating instructions are intended exclusively for trained specialists in control technology and automation with the relevant knowledge.

The trained specialist personnel must ensure that the applications and use of the described product meet all safety requirements. This includes all applicable and valid laws, regulations, provisions and standards.

### Trained specialists

Trained specialists have extensive technical knowledge from studies, apprenticeships or technical training. Understanding of control technology and automation is available. Trained specialists can:

- Independently identify, avoid and eliminate sources of hazard.
- Apply relevant standards and directives.
- Implement specifications from accident prevention regulations.
- Evaluate, prepare and set up the workplaces.
- Evaluate, optimize and execute work independently.

## 1.4 Safety and instruction

Read the contents that refer to the activities you have to perform with the product. Always read the chapter For your safety in the operating instructions.

Observe the warnings in the chapters so that you can handle and work with the product as intended and safely.

### Explanation of symbols

Various symbols are used for a clear arrangement:

- 1. The numbering indicates an action that should be taken.
- The bullet point indicates an enumeration.
- [...] The square brackets indicate cross-references to other text passages in the document.
- [1] The number in square brackets indicates the numbering of a referenced document.

The signal words used in the documentation are classified below.

### Signal words

#### Warning of personal injuries

<b>⚠ DANGER</b>
Hazard with high risk of death or serious injury.
<b>⚠ WARNING</b>
Hazard with medium risk of death or serious injury.
<b>⚠ CAUTION</b>
There is a low-risk hazard that could result in medium or minor injury.

#### Warning of damage to property or environment

<b>NOTICE</b>
<b>Notes</b>
The environment, equipment, or data may be damaged.

#### Information on handling the product



This information includes, for example:  
 Recommendations for action, assistance or further information on the product.

## 1.5 Support and Service

Beckhoff and their partners around the world offer comprehensive support and service, making available fast and competent assistance with all questions related to Beckhoff products and system solutions.

### Download finder

Our [download finder](#) contains all the files that we offer you for downloading. You will find application reports, technical documentation, technical drawings, configuration files and much more.

The downloads are available in various formats.

### Beckhoff's branch offices and representatives

Please contact your Beckhoff branch office or representative for [local support and service](#) on Beckhoff products!

The addresses of Beckhoff's branch offices and representatives round the world can be found on our internet page: [www.beckhoff.com](http://www.beckhoff.com)

You will also find further documentation for Beckhoff components there.

### Beckhoff Support

Support offers you comprehensive technical assistance, helping you not only with the application of individual Beckhoff products, but also with other, wide-ranging services:

- support
- design, programming and commissioning of complex automation systems
- and extensive training program for Beckhoff system components

Hotline: +49 5246 963-157  
e-mail: [support@beckhoff.com](mailto:support@beckhoff.com)

### Beckhoff Service

The Beckhoff Service Center supports you in all matters of after-sales service:

- on-site service
- repair service
- spare parts service
- hotline service

Hotline: +49 5246 963-460  
e-mail: [service@beckhoff.com](mailto:service@beckhoff.com)

### Beckhoff Headquarters

Beckhoff Automation GmbH & Co. KG

Huelshorstweg 20  
33415 Verl  
Germany

Phone: +49 5246 963-0  
e-mail: [info@beckhoff.com](mailto:info@beckhoff.com)  
web: [www.beckhoff.com](http://www.beckhoff.com)

## 1.6 Notes on information security

The products of Beckhoff Automation GmbH & Co. KG (Beckhoff), insofar as they can be accessed online, are equipped with security functions that support the secure operation of plants, systems, machines and networks. Despite the security functions, the creation, implementation and constant updating of a holistic security concept for the operation are necessary to protect the respective plant, system, machine and networks against cyber threats. The products sold by Beckhoff are only part of the overall security concept. The customer is responsible for preventing unauthorized access by third parties to its equipment, systems, machines and networks. The latter should be connected to the corporate network or the Internet only if appropriate protective measures have been set up.

In addition, the recommendations from Beckhoff regarding appropriate protective measures should be observed. Further information regarding information security and industrial security can be found in our <https://www.beckhoff.com/secguide>.

Beckhoff products and solutions undergo continuous further development. This also applies to security functions. In light of this continuous further development, Beckhoff expressly recommends that the products are kept up to date at all times and that updates are installed for the products once they have been made available. Using outdated or unsupported product versions can increase the risk of cyber threats.

To stay informed about information security for Beckhoff products, subscribe to the RSS feed at <https://www.beckhoff.com/secinfo>.

## 2 Use

We recommend using the latest TwinCAT version for your applications.

Function	From version
User FB definitions	TwinCAT version 4024.0 or higher
User FB-Libs functions	TwinCAT version 3.1 4024.10 or higher

## 3 Create User FBs

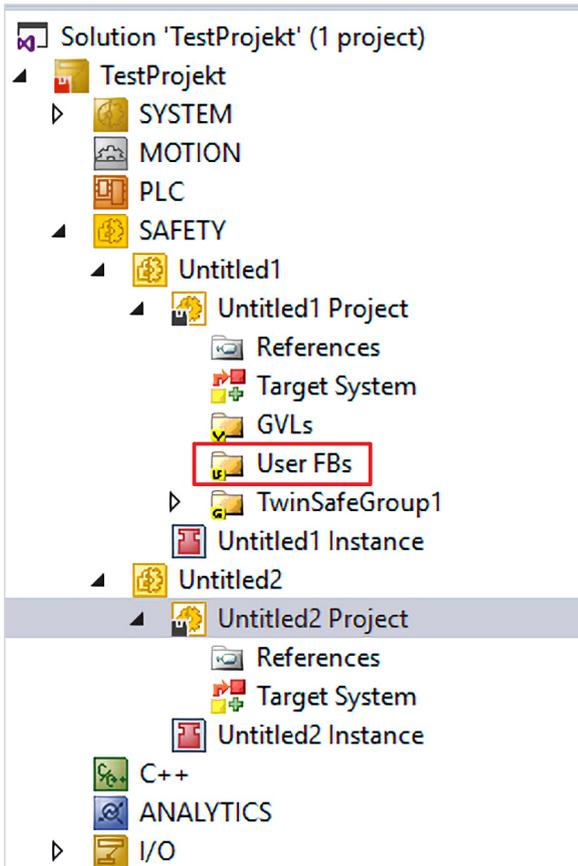
### 3.1 Create new

Proceed as follows to create a User FB:

1. Create a new Safety project

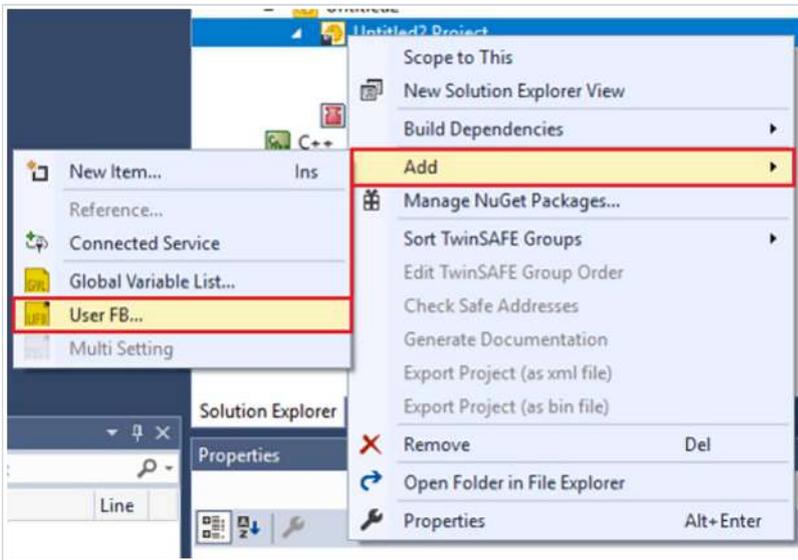
You automatically create a User FB folder.

This does not apply to the “TwinCAT Empty Safety Project” template, where you do not automatically create a User FB folder.



**If a User FB folder already exists:**

2. Right-click on the User FB folder



3. Select "User-FB..." via the Add command to create a User FB definition file (.ufb)

#### If there is no User FB folder yet:

4. Right-click on Safety project
5. Select "User-FB..." via the Add command to create a User FB definition file (.ufb)

If you add a User FB directly via the Safety project, this procedure automatically creates a User FB folder together with the definition file (.ufb).

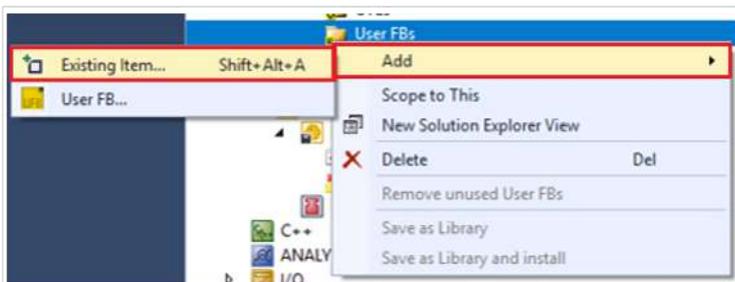
## 3.2 Reuse

Two procedures are available for reusing a User FB after it has been created in a Safety project.

### 3.2.1 Add an existing User FB

You have the option of reusing User FBs that have already been created. Proceed as follows:

1. Right-click on the User FB folder



2. Select "Existing Item..." in the context menu via the Add command

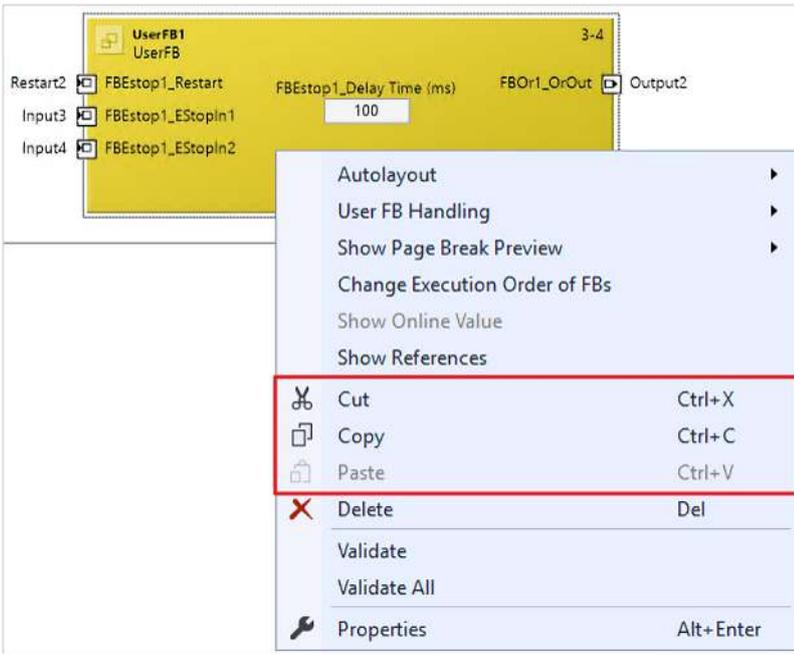
User FB definition files consist of two files: ufb file and ufb.diagram file. The ufb file describes the logic. The ufb.diagram file describes the layout of a User FB definition file.

For this reason, you must always select the ufb files when adding existing User FBs.

If the ufb.diagram files are in the same folder as the ufb files, the diagram files are automatically included. If the ufb.diagram files are missing, you will no longer receive the original layout of the User FB definition.

### 3.2.2 About Copy/Cut/Paste

If a TwinCAT project contains multiple Safety projects, you can copy or cut the User FBs and paste them into another project.



Proceed as follows:

1. Right-click on the User FB
2. Select "Cut" or "Copy" to cut or copy the User FB
3. Select "Paste" to insert the User FB at the desired location

The Paste command is grayed out as long as you have not cut or copied a User FB. As soon as you have cut or copied a User FB, you can select the "Paste" command.

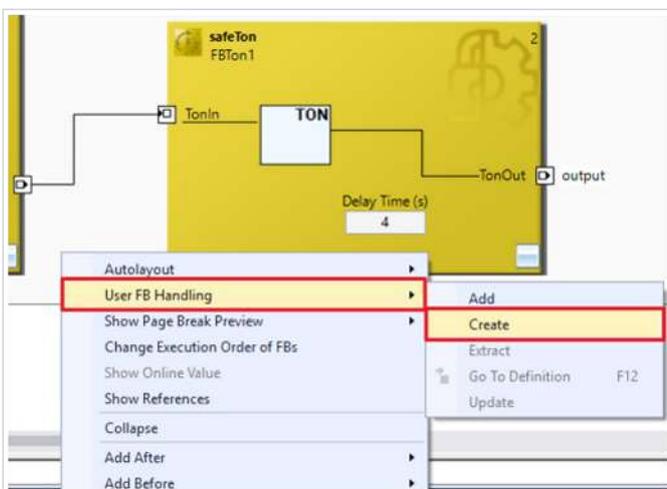
### 3.3 Creating User FBs from existing applications

**i** **Validity**

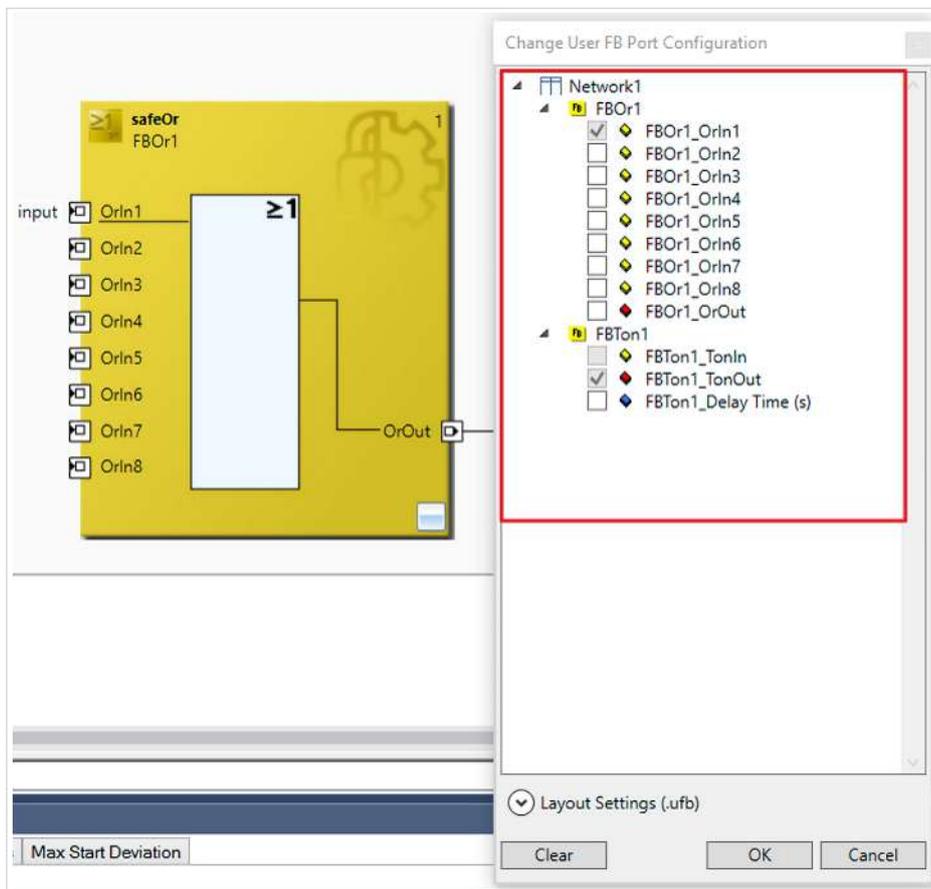
The diagram file must be valid so that a User FB can be created from an application.

To create User FBs from existing applications, proceed as follows:

1. Right-click on an existing FB

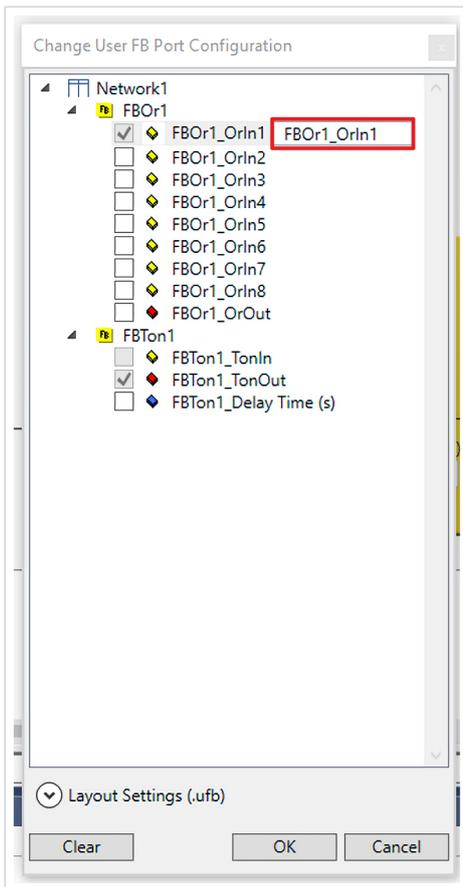


2. Select the "Create" command in the context menu via "User FB Handling"

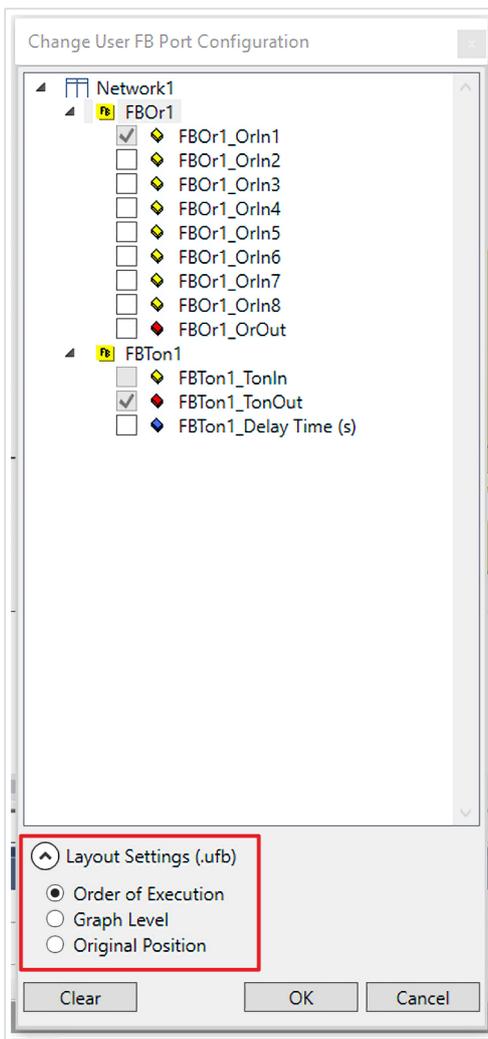


The "Change User FB Port Configuration" dialog appears.

Depending on where you call the FB context menu, either the entire file content, the function blocks in a network or the selected FBs are displayed for selection for the new User FB. Please note that you can only combine FBs that are executed consecutively.



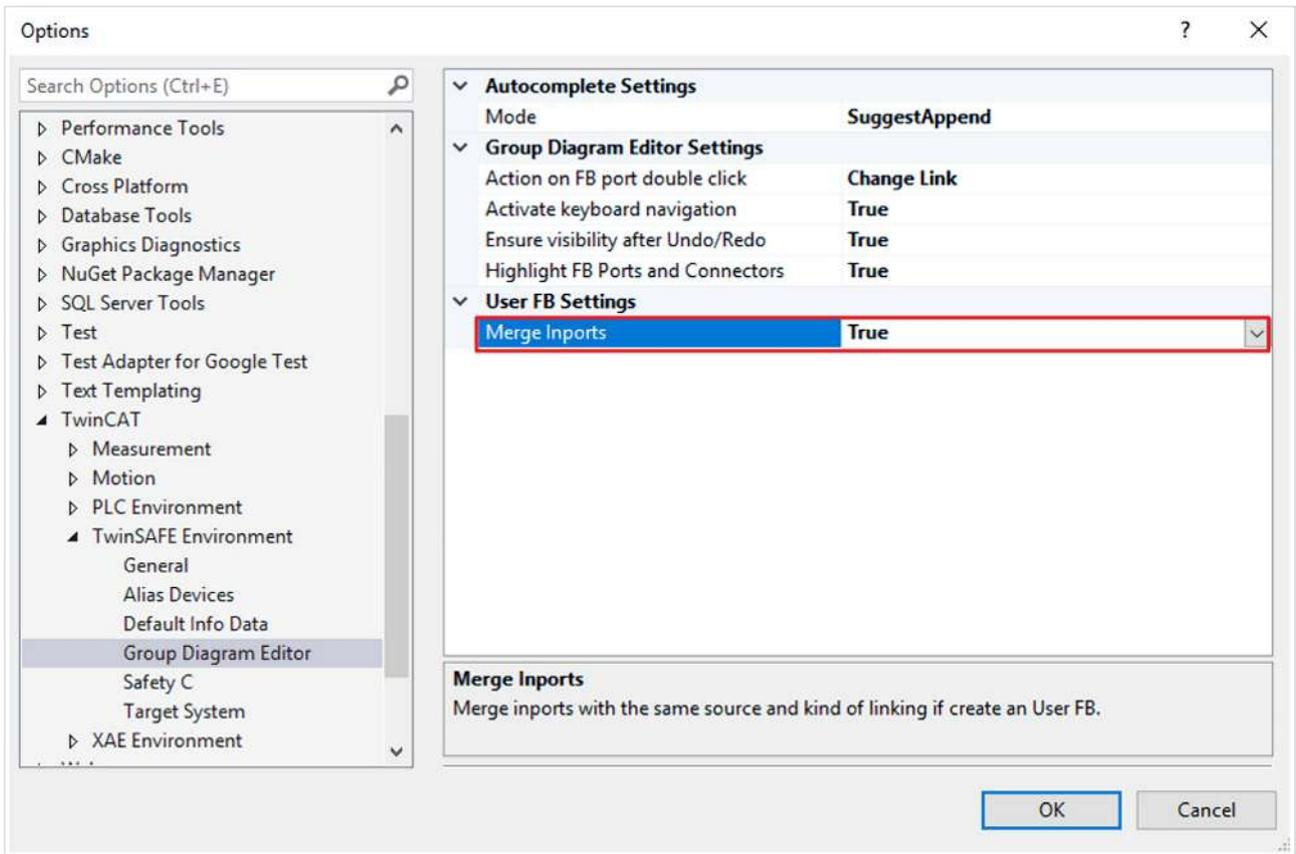
If variable links already exist at the inports or outports, these are automatically marked as inports or outports of the new User FBs. You can optionally select other inports or outports as well as ParameterPorts in the dialog. You also have the option of changing the port names via the dialog by double-clicking on a port.



The layout settings allow you to specify the arrangement of the new User FBs.

### **i** Comment

You can nest User FBs in up to two levels. This means that you can create new User FBs from existing User FB instances. The "Merge Ports" option allows you to specify whether ports should be merged when creating a User FB.



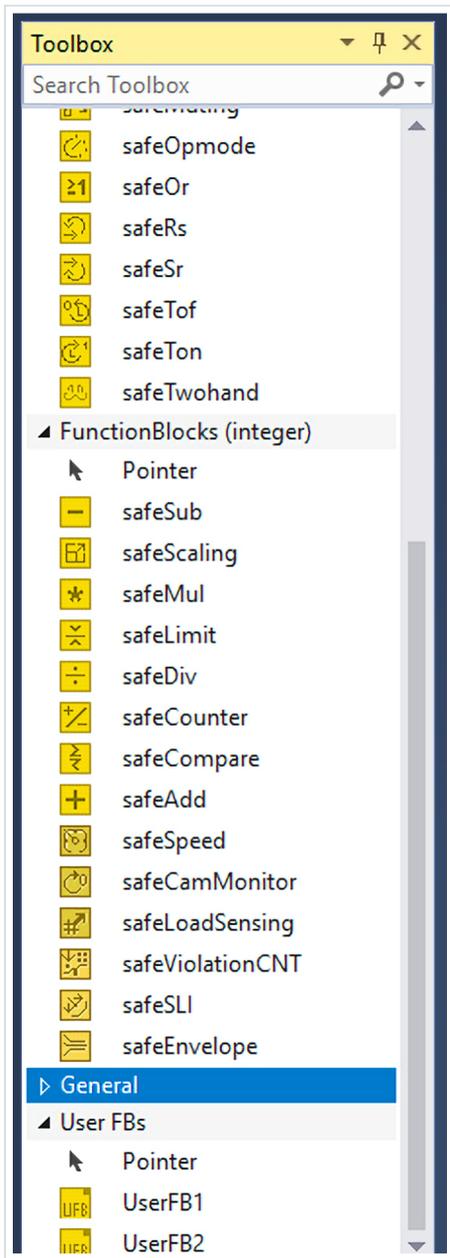
## 4 Use User FBs

User FBs are used as User FB instances in a sal file or ufb file.

The following chapters describe various ways to create a User FB instance.

### 4.1 About the Toolbox

If a User FB definition exists in a Safety project, you can insert the User FB instances into the application via the Toolbox, for example using "drag & drop".

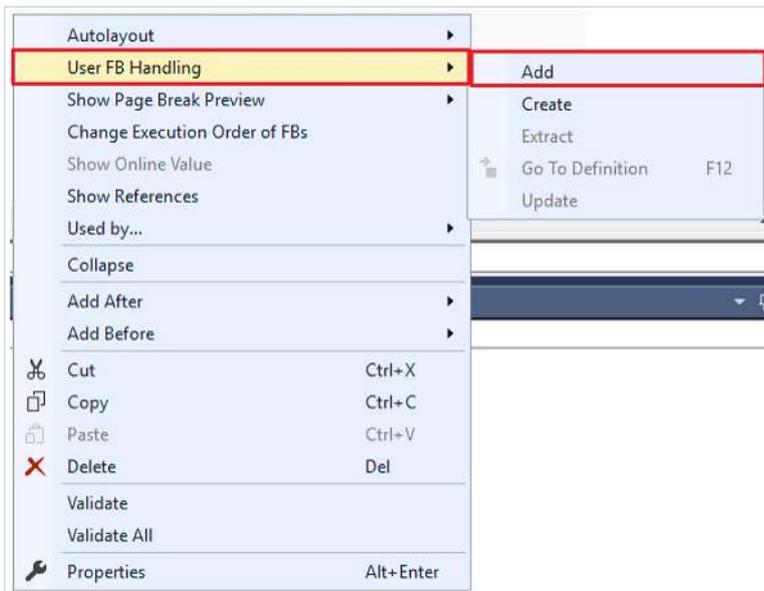


You have the option of creating any number of User FB instances. The number of User FB instances is only limited by the executing hardware, such as EL6910.

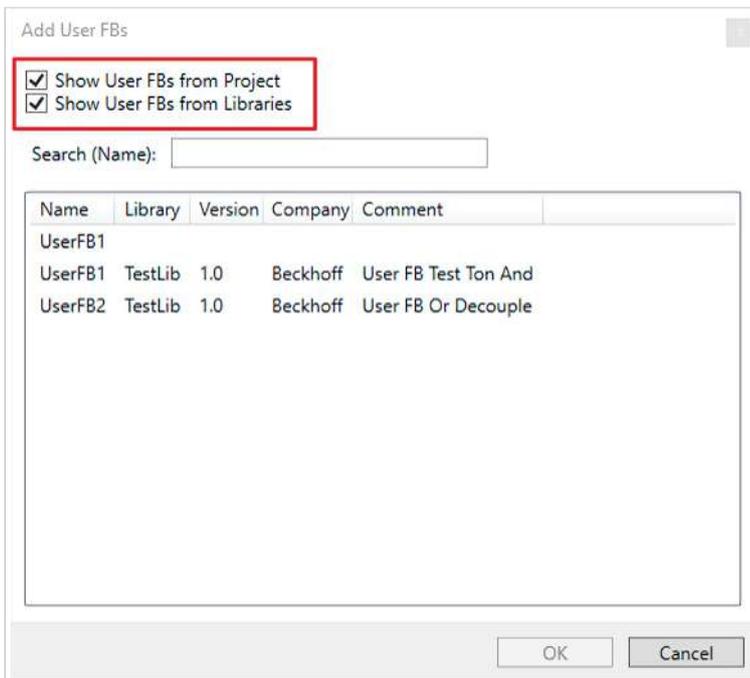
In contrast to the Add command described below, you can only use the Toolbox to perform actions with individual User FBs.

### 4.2 About the "Add" command

Proceed as follows:



1. Right-click on the network area of the sal file or ufb file
2. Select the "Add" command in "User FB Handling"



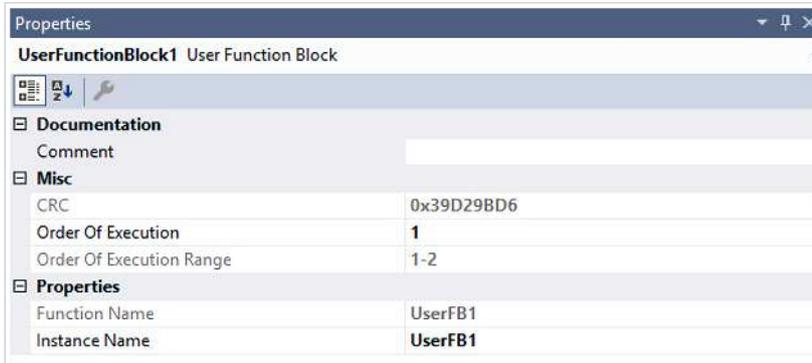
The following is a list of the User FBs from the project and the User FB libraries.

In contrast to the procedure with the Toolbox, here you have the option of selecting, inserting and searching for several User FBs at the same time.

3. Select one or more User FBs
4. Press "OK" to confirm your selection

## 5 User FB instance

### 5.1 Properties



In the Properties window of a User FB instance, you can make the following settings:

- Comment function
- changeable instance name
- Function Name; corresponds to the name of the User FB definition file
- changeable order of execution
- Checksum; is displayed via the User FB definition file

### 5.2 Extract

To extract a User FB instance, proceed as follows:

1. Select the User FB to be extracted
2. Right-click on the sal file or ufb file of the User FB instance
3. Select the "Extract" command via "User FB Handling"

### 5.3 Update

In some cases, the status of the User FB definition file may differ from that of the corresponding User FB instance.

This can be the case, for example, with undo or redo operations and with version controls.

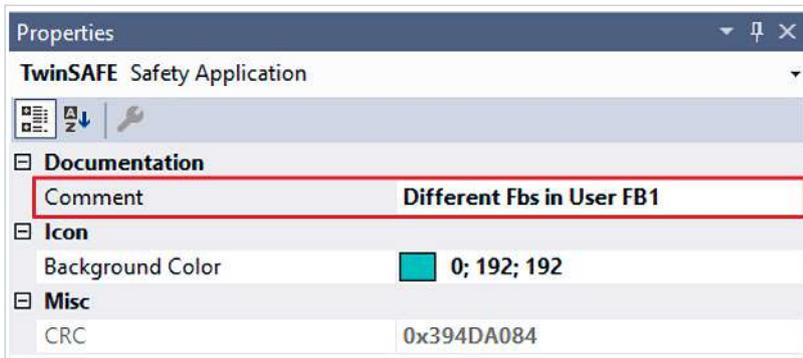
If the definition file and the instance have different statuses, a corresponding error message appears after executing the "Verify Project" command.

Proceed as follows to change the User FB instance back to the current status:

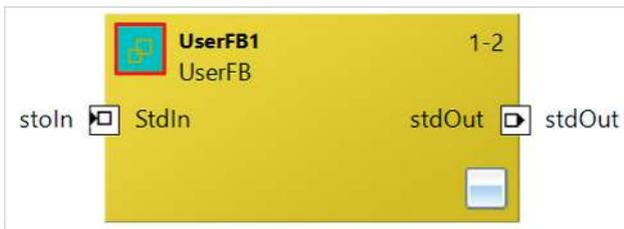
1. Right-click on the sal file or the ufb file
2. Select the "Update" command via "User FB Handling"

## 6 User FB definition

### 6.1 Properties



The User FB definition allows you to create a comment for your User FB instance. Unless you overwrite the comment, your comment will appear in the "Add User FB" dialog, as well as on the corresponding User FB Toolbox item and User FB instance as a tooltip. When using the User FBs in the sal file, however, you can still edit the comment. This change has no effect on the definition of the original User FB.



You can also adjust the background color of the top left icon.

The CRC appears in all associated instances.

#### ● Changed CRC after project upgrade

**i** The CRC of the User FB definition is calculated based on the entire contents of the ufb file. This means that the CRC may change after a project upgrade, for example after incrementing the file version.

If you want to avoid changing the CRC, save the User FB definition in a User FB library and use the definition from the library. This procedure saves the current status of the User FB definition.

### 6.2 Variables

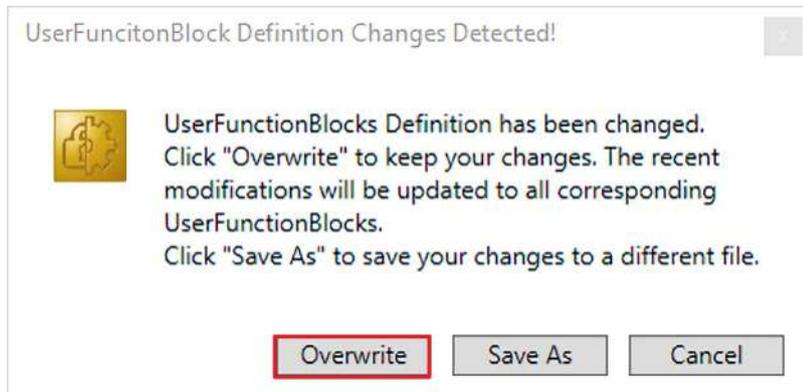
Variable Mapping					
Variables					
Variable	Local	Assignment	Usages	Online Value	Comment
Rest	<input type="checkbox"/>	...	Network1.FBEstop1.Restart		Reset comment on Estop1
E_Out	<input type="checkbox"/>	Network1.FBEstop1.EStopOut	...		
E1	<input type="checkbox"/>	...	Network1.FBEstop1.EStopIn1 Network1.FBTon1.TonIn		
E2	<input type="checkbox"/>	...	Network1.FBEstop1.EStopIn3		
tonOut	<input checked="" type="checkbox"/>	Network1.FBTon1.TonOut	Network2.FBMon1.MonIn1		
eout2	<input type="checkbox"/>	Network1.FBEstop1.EStopOut	...		
Variable1	<input type="checkbox"/>	Network1.FBTon1.TonOut	...		

You can use variables several times in the User FB definition. You also have the option of using the variables for local mappings via the "Local" variable property.

The relationship 1:n applies for inport of the User FB instance and inport of the User FB application.

The relationship n:1 applies to the outport of the User FB instance and the outport of the User FB application.

### 6.3 Save User FB definition



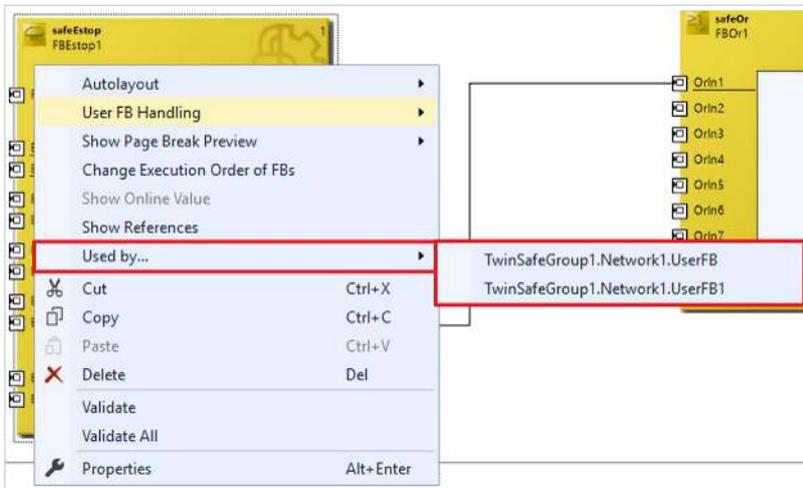
A control window appears. Here you can choose between the following options:

- Overwrite: the changes made are applied and the previous settings are overwritten. This applies to all affected User FB instances.
- Save As: the changes made are applied and saved in a separate file.
- Cancel: the change process is canceled.

# 7 Relationship between User FB instance and User FB definition

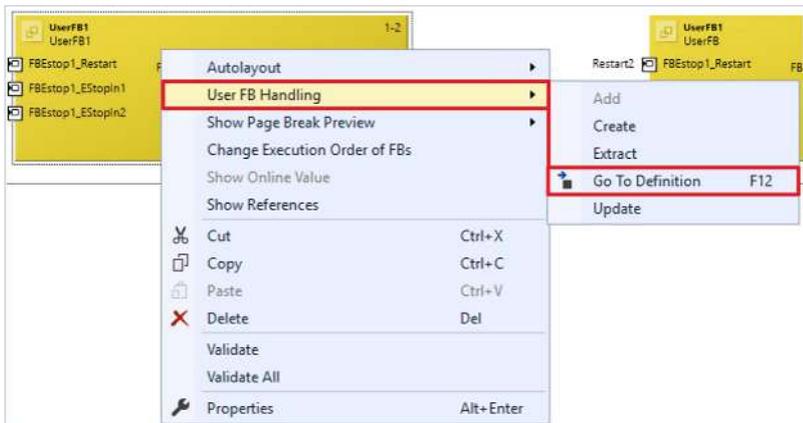
A User FB instance and a User FB definition are related to each other via an ID and the CRC of the ufb file.

How to get from the User FB definition to the User FB instance:



1. Right-click on the ufb file
2. Select the "Used by" command in the context menu
3. Select the instance

How to get from the User FB instance to the User FB definition:



4. Right-click on the User FB instance
5. Select the "Go to Definition" command via "User FB Handling"

The shortcut for "Go to Definition" is F12.

This procedure also applies if you want to go from an FB port of a User FB instance to the base FB port or the base variable. On the other hand, you can access User FB instances or User FB ports from the User FB definition using the "Used By" command.

## 8 User FB libraries

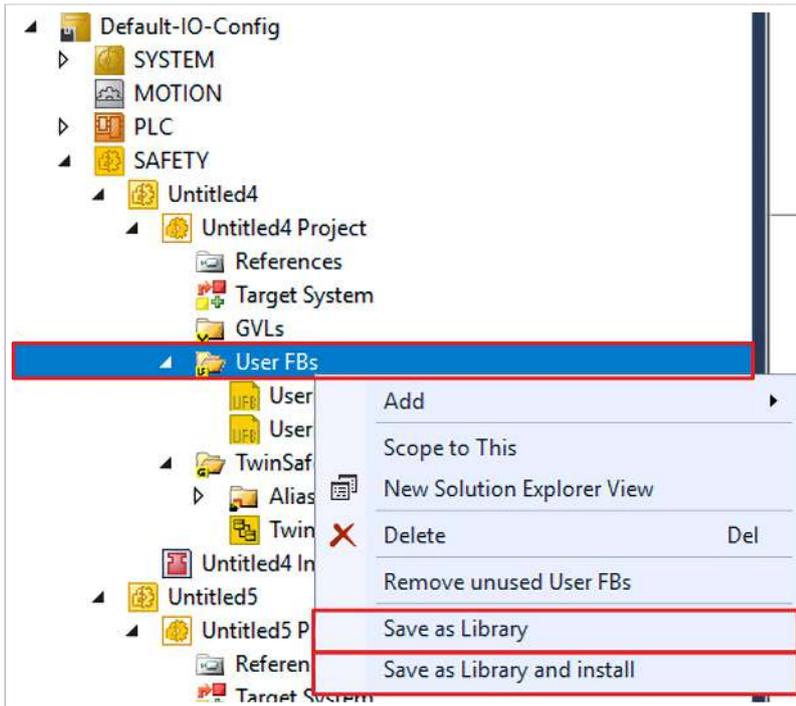
### 8.1 Saving User FBs in libraries

#### ● Creating User FB libraries

**i** To create User FB libraries, you need a project that uses User FBs.

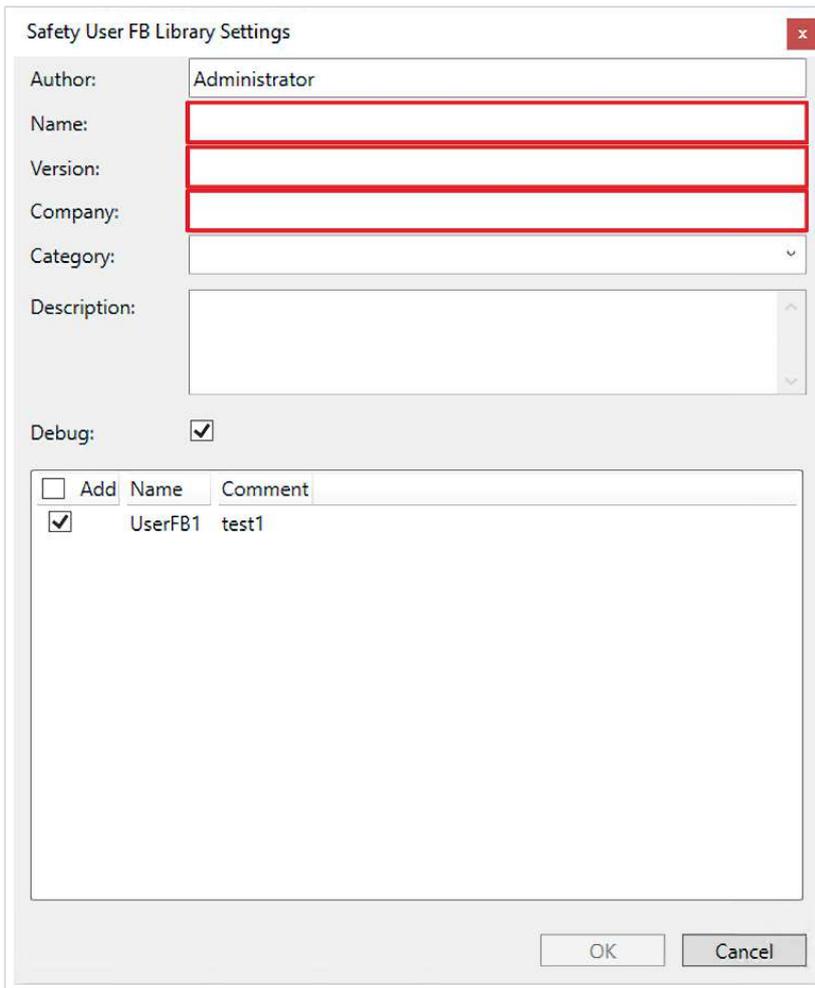
In addition to User FBs, you also have the option of creating User FB libraries.

If you already have a valid project that uses User FBs, proceed as follows:



1. Right-click on the User FB folder
2. Select "Save as Library" or "Save as Library and install"

If you select "Save as library and install", the library will also be saved and installed in the repository set.



3. Enter required data "Name", "Version" and "Company"
4. Select User FBs

**● Select all User FBs**



When selecting User FBs, make sure to select all interdependent and nested User FBs. If you do not select all the User FBs that depend on each other, no library will be created.

**● Reading the file contents of a library**



The Debug Flag message shows the release state of the library. If Debug = False, the library is encrypted and you can no longer view the implementation.

5. Press "OK" to confirm your selection

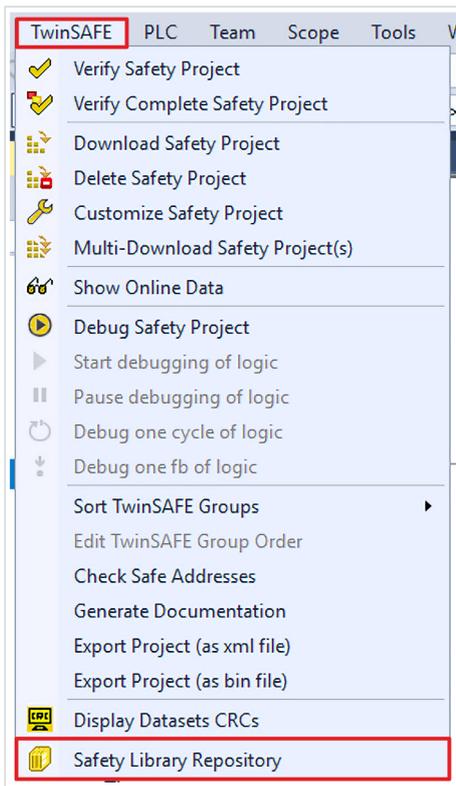
If you have not saved and installed the library in the repository yet, you can do so using the Repository Manager.

Because creating User FB libraries depends on the target system, the target system's information is saved in the library when it is created. This includes the target system type and the firmware version used. If you use a library in a different target system environment, warnings are issued during verification.

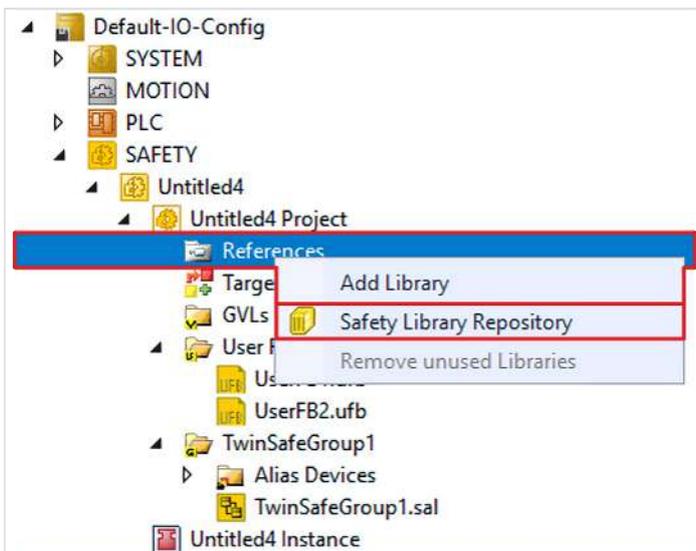
A library is identified by its name, company name, version, ID (GUID), and CRC checksum. When loading a project with referenced User FB libraries, this information is checked and, in the event of discrepancies, reported to the user in the verification or corresponding icons are displayed in the tree.

## 8.2 Respository Manager

How to open the Respository Manager:

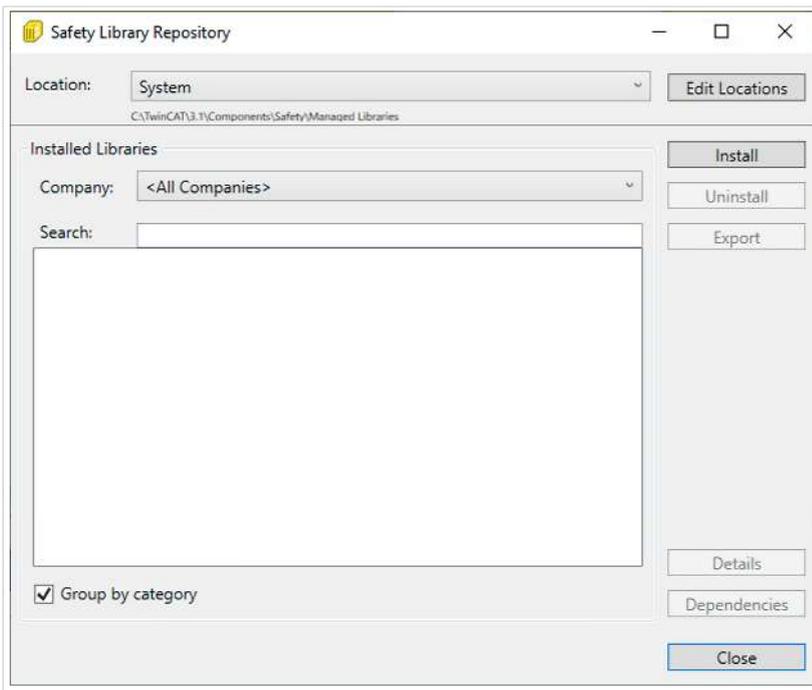


1. Open the "TwinSAFE" tab in the menu bar



2. Alternatively, right-click on the References folder in the Safety project

3. Select "Safety Library Respository"

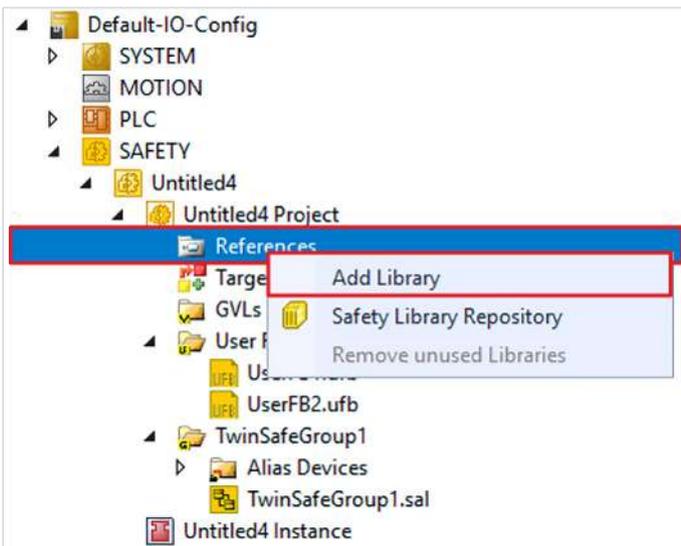


In the Repository Manager you can

- create new storage locations
- install and uninstall libraries
- export libraries
- view libraries

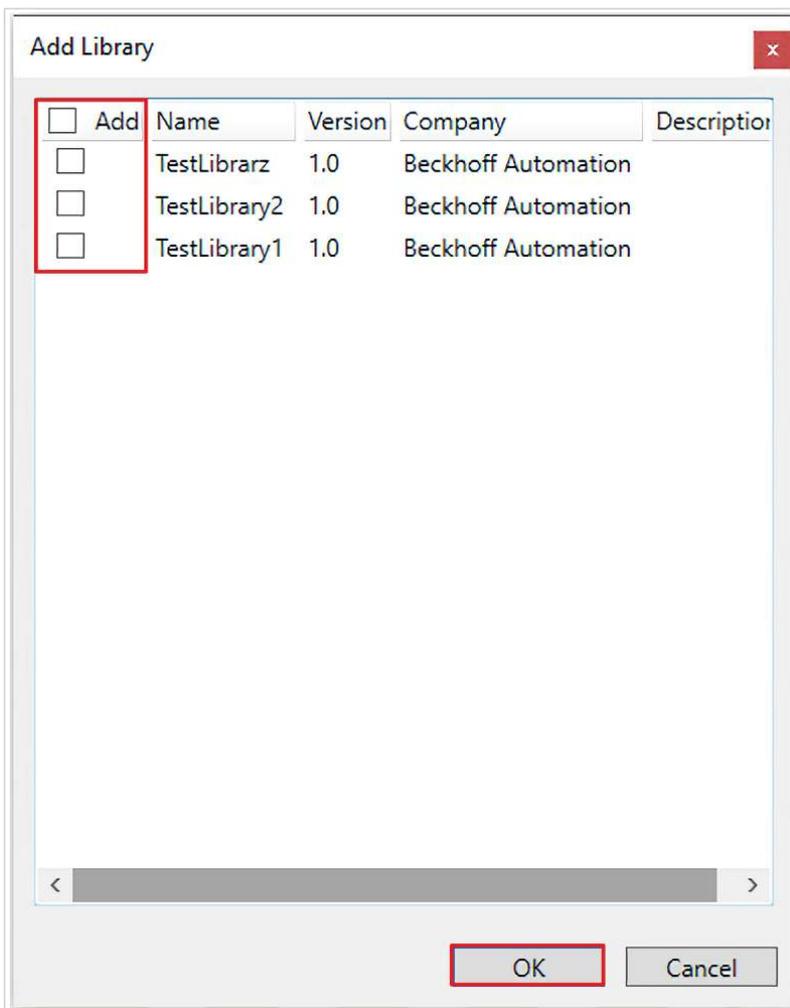
### 8.3 Add library

Proceed as follows to add a library:

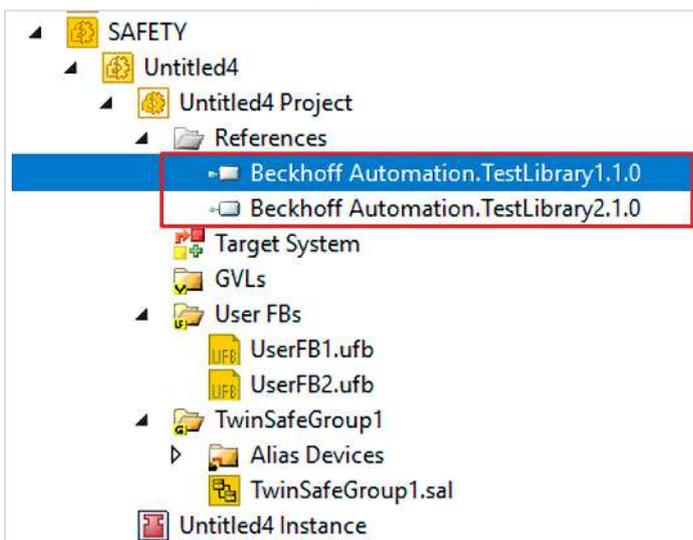


1. Right-click on the References folder
2. Execute the "Add Library" command

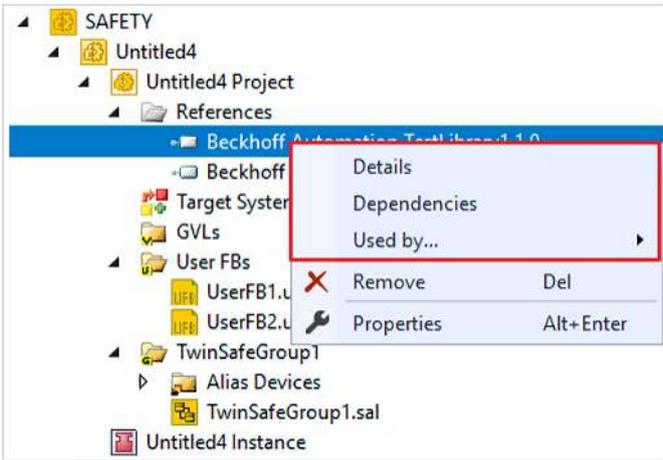
In Safety Editor versions that support references, the References node is always visible and cannot be deleted.



3. Select a library
4. Press "OK" to confirm your selection



The visible reference name consists of the company name, the library name and the version. Make sure that the reference name is unique.

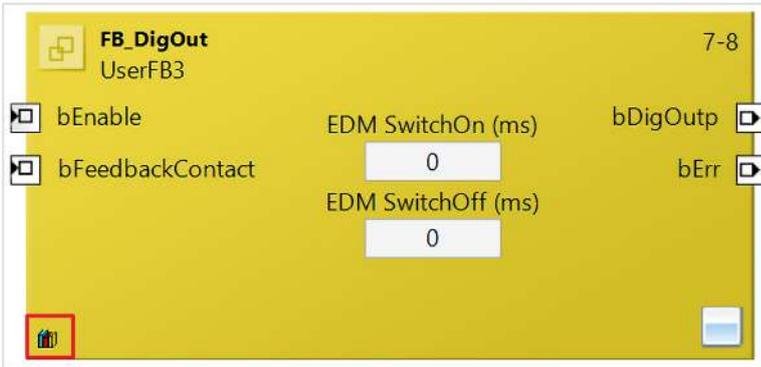


You can use a single reference node to execute further commands, such as viewing the details, dependencies or usage in the project.

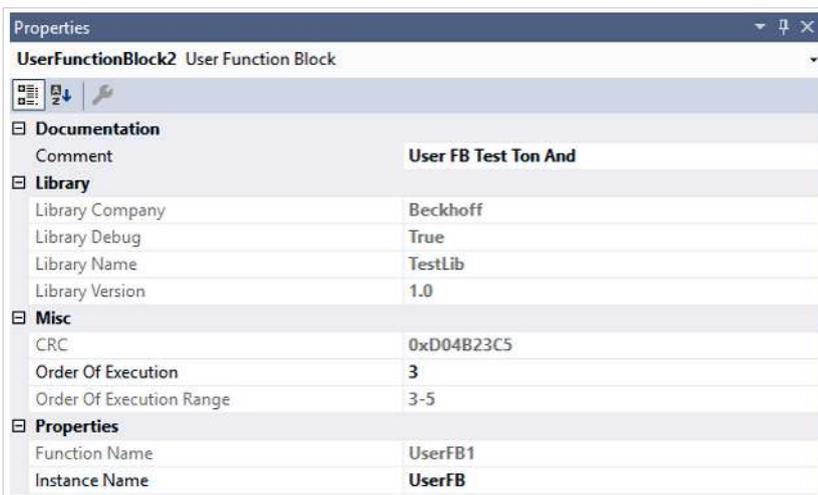
## 8.4 Using User FBs from libraries

The User FB library consists of a debug file (.ufbllib) or a release file (.sufbllib).

You can add a User FB instance from a User FB library to a project via the context menu of a group application or a User FB application. Further information on adding a User FB instance can be found in the chapter [About the "Add" command \[► 18\]](#).



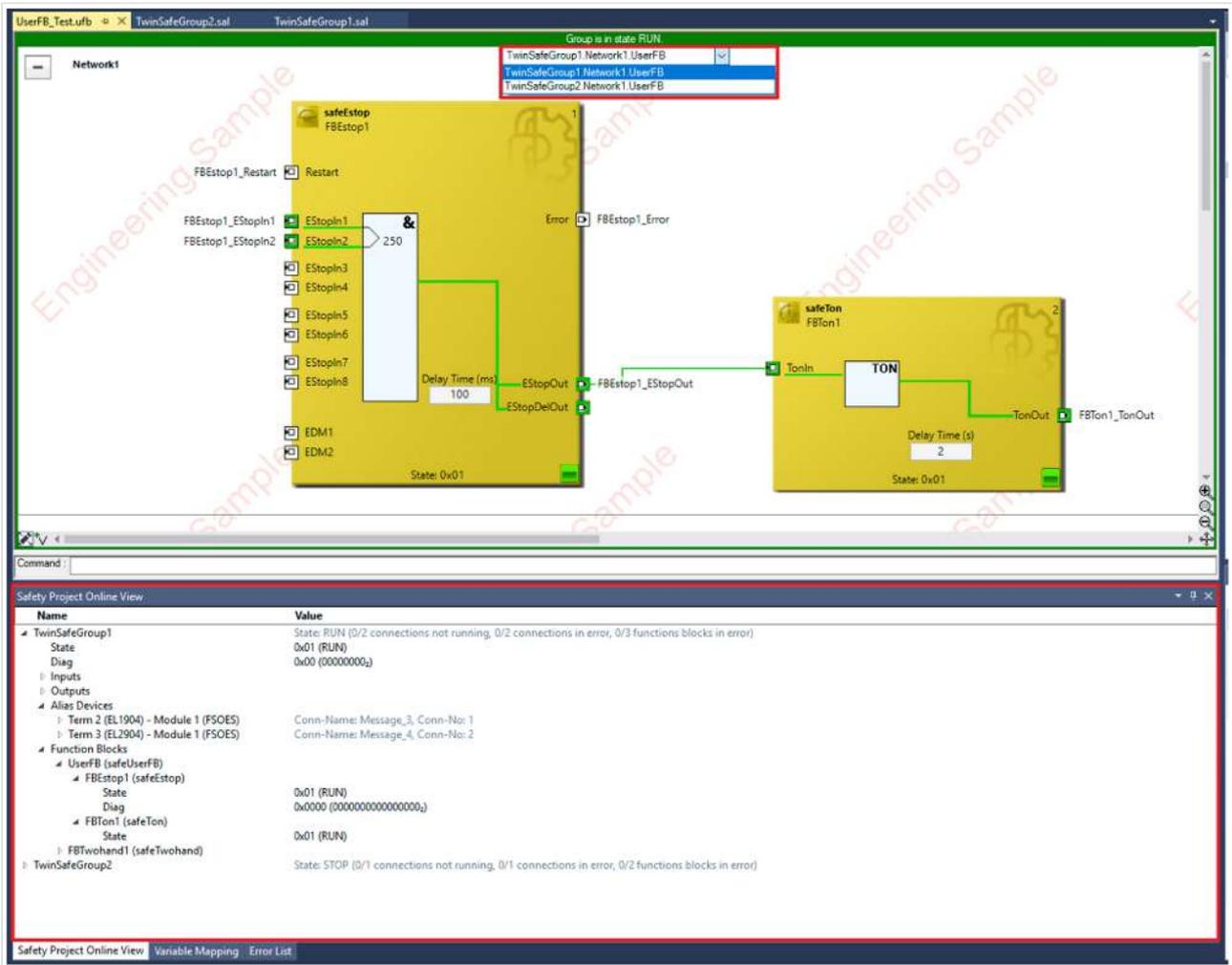
A User FB instance from a library has a repository icon at the bottom left.



The function blocks also contain information on their properties and some important parameters of the library used.

# 9 Online View

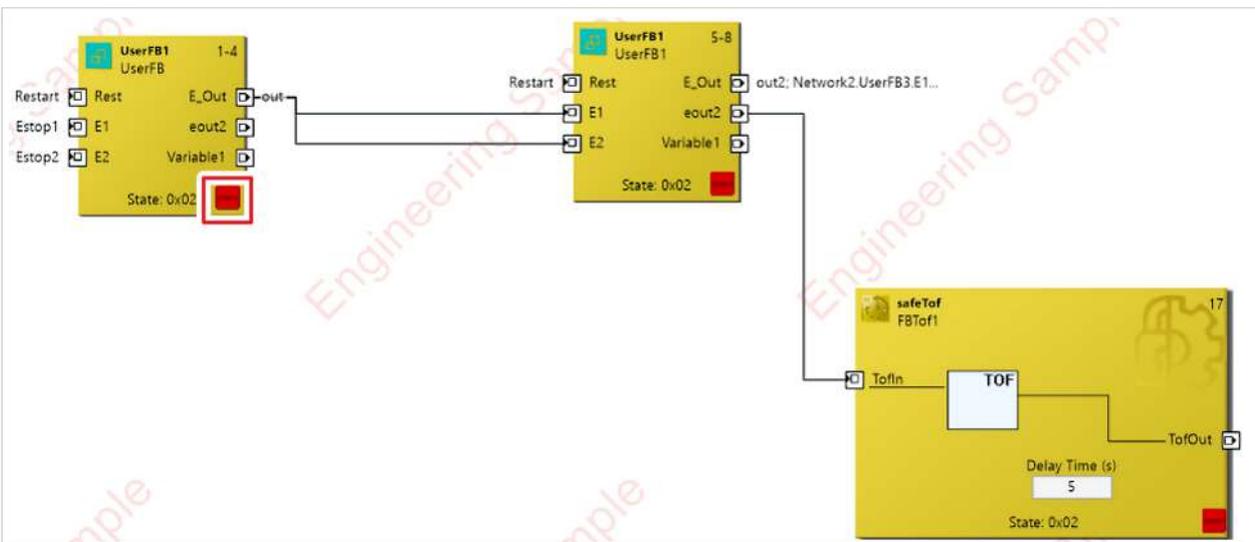
The Online View is located in the User FB definition. The Online View is dependent on the User FB instance.



After activating Online View, a drop-down menu will appear in your application.

Select the instance in this drop-down menu.

In the Toolbox, the User FBs appear before the basic FBs.



In addition, there is an icon in the Online View of the User FB instance that displays the FB status. If all internal FBs have the same status or an internal FB has an error, this information is forwarded to the User FB instance and the icon appears. The icon will not be displayed if none of these cases apply.

## 10 Documentation

The User FBs and the User FB libraries are described in the documentation.

## 11 TC3 Export/Import

During export, User FBs are logically exported in TC3.xml. Logical means that no layout information is exported.

User FB libraries are only referenced.

## **Trademark statements**

Beckhoff®, ATRO®, EtherCAT®, EtherCAT G®, EtherCAT G10®, EtherCAT P®, MX-System®, Safety over EtherCAT®, TC/BSD®, TwinCAT®, TwinCAT/BSD®, TwinSAFE®, XFC®, XPlanar®, and XTS® are registered and licensed trademarks of Beckhoff Automation GmbH.

More Information:  
**[www.beckhoff.com/TE9000](http://www.beckhoff.com/TE9000)**

Beckhoff Automation GmbH & Co. KG  
Hülshorstweg 20  
33415 Verl  
Germany  
Phone: +49 5246 9630  
[info@beckhoff.com](mailto:info@beckhoff.com)  
[www.beckhoff.com](http://www.beckhoff.com)

